

Appl. No. 09/442,111
Amdt. dated July 20, 2004
Reply to Office Action of February 20, 2004

PATENT

Amendments to the Drawings:

The attached sheets of drawings includes changes to all figures except Fig. 3. These sheets, which includes Figs. 1A, 1B, 2, 3, 4A, 4B, 5A, 5B, 6, 7A, 7B, 7C, 7D, 8, 9, 10, 11A and 11B (a total of 13 sheets) replace the original sheets filed on November 17, 1999.

Attachment: Replacement Sheets
Annotated Sheets Showing Changes

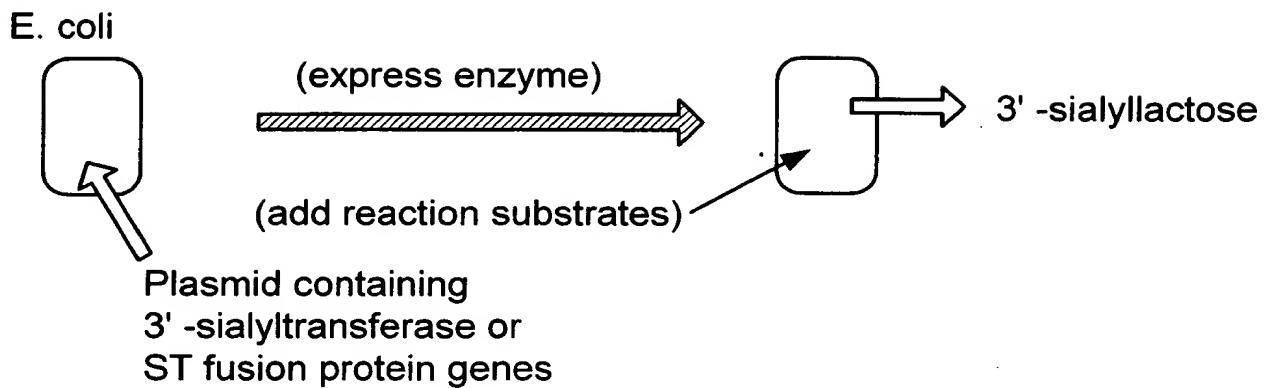
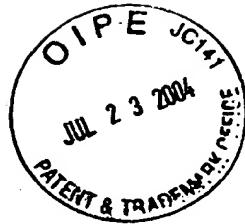


FIG. 1A.

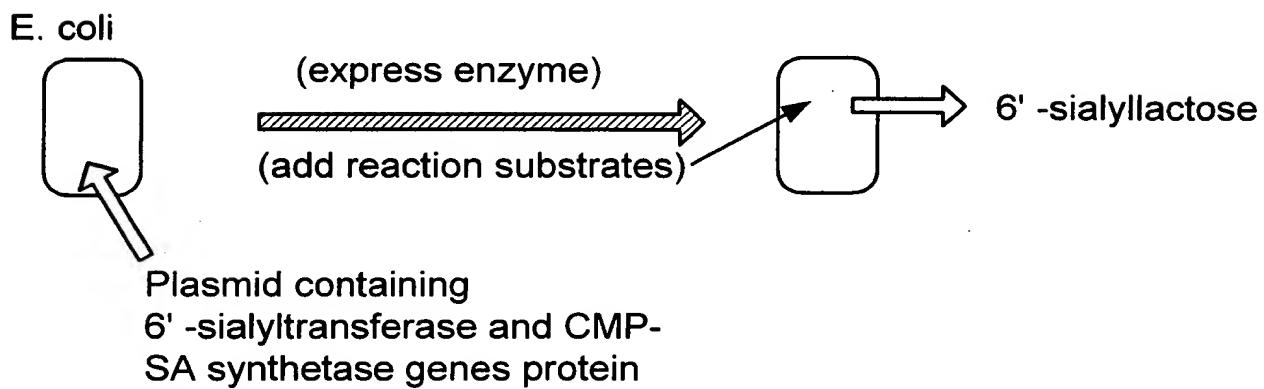


FIG. 1B.



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Replacement Sheet

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E. coli

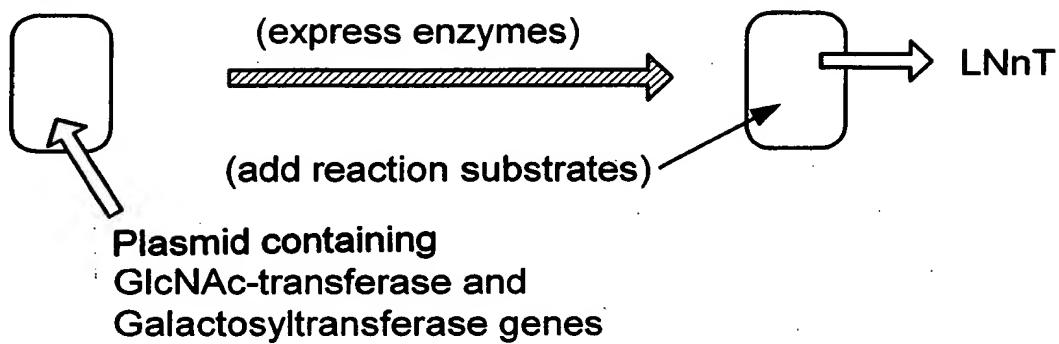
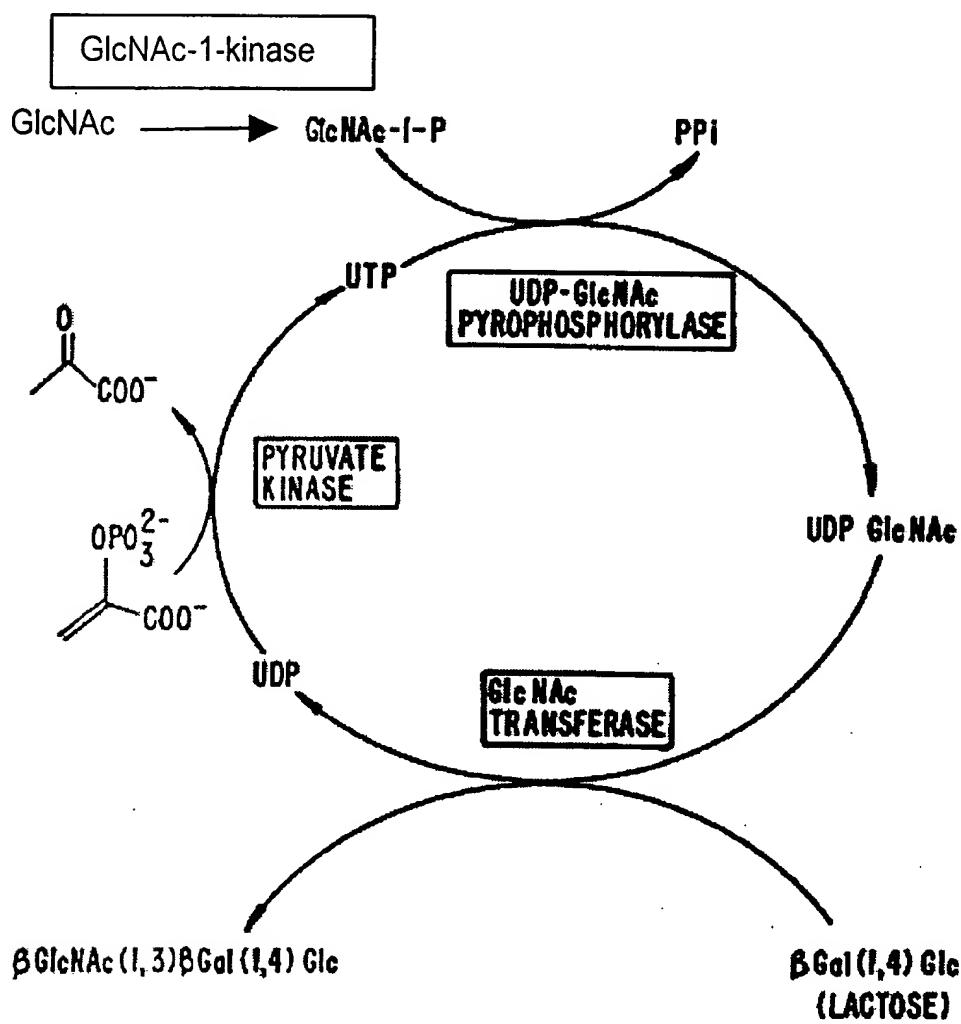
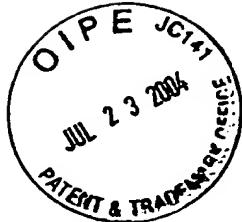


FIG. 2.



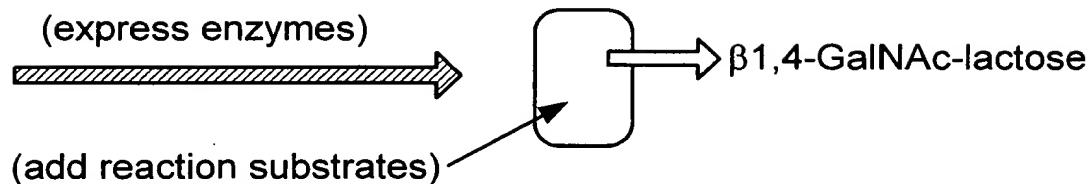
Figure 3





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E. coli

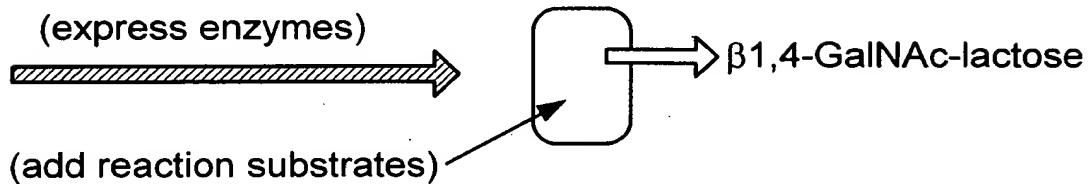
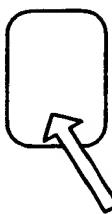


β 1,4-GalNAc-lactose

Plasmids, one encoding
 α 1,4-GalNAc-transferase, UDP-GalNAc
epimerase, UDP-GlcNAc pyrophosphorylase
genes and the second encoding GlcNAc-
1-kinase, polyphosphate kinase and pyruvate
kinase genes)

FIG. 4A.

E. coli



β 1,4-GalNAc-lactose

Plasmids containing beta 1,4-GalNAc-
transferase, UDP-GalNAc pyrophosphorylase,
GlcNAc 1-kinase, polyphosphate kinase and
pyruvate kinase genes

FIG. 4B.

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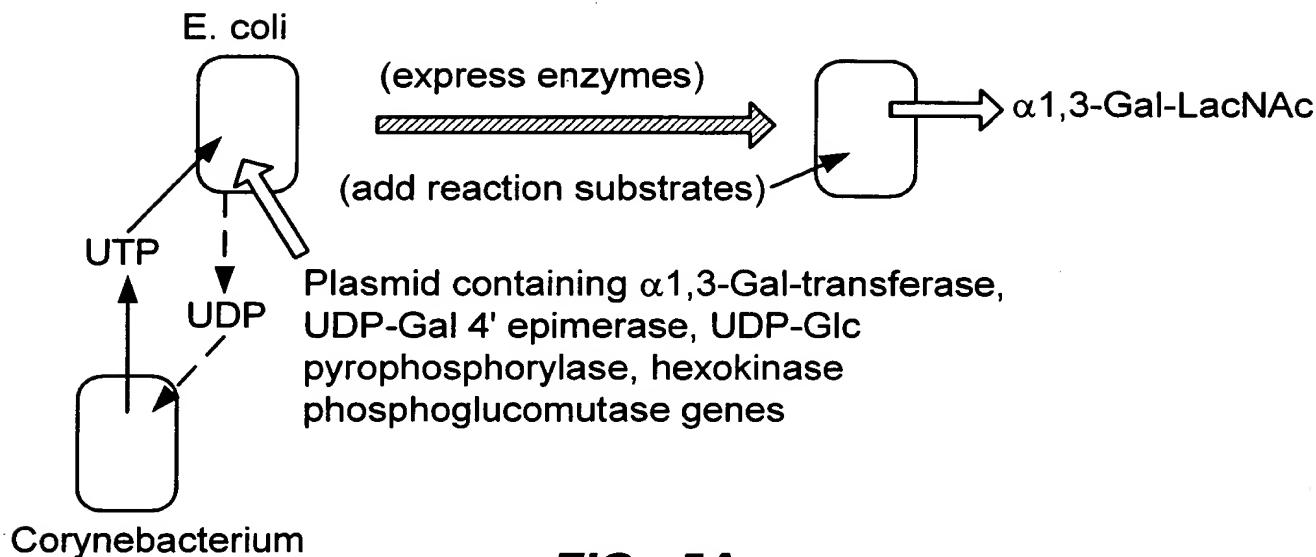


FIG. 5A.

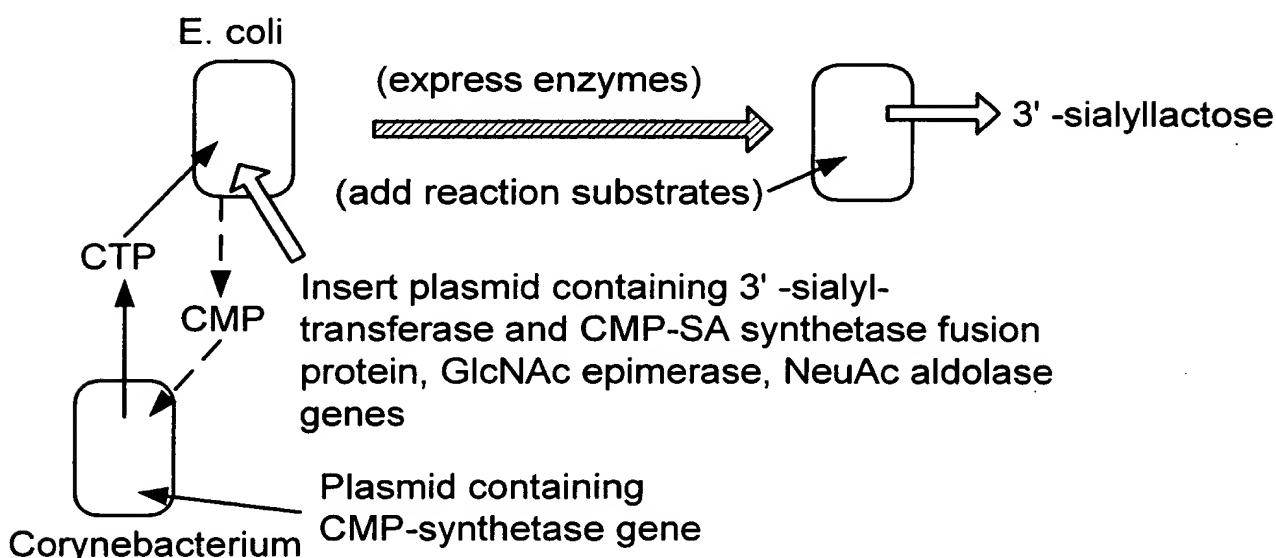


FIG. 5B.

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Replacement Sheet

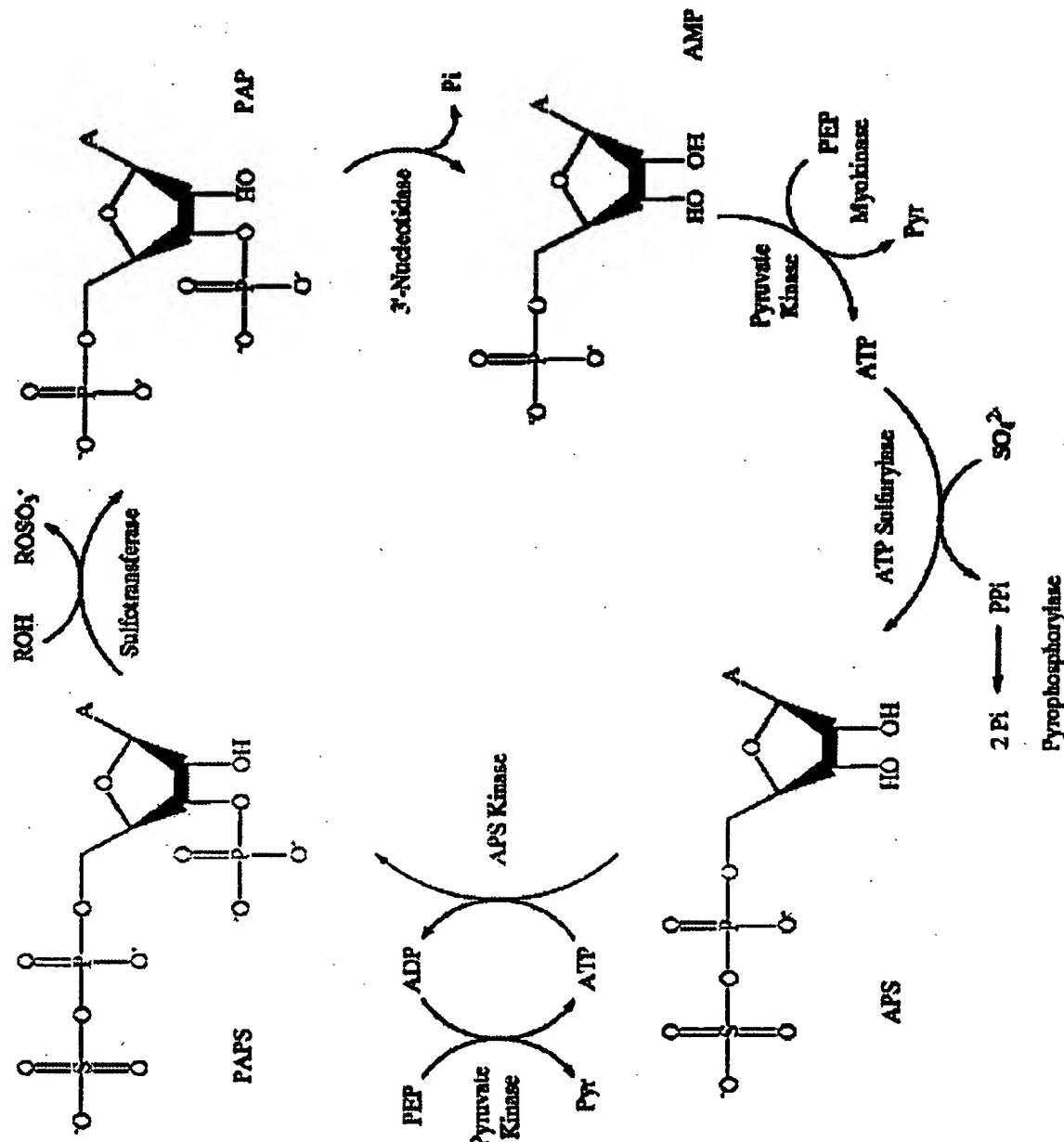
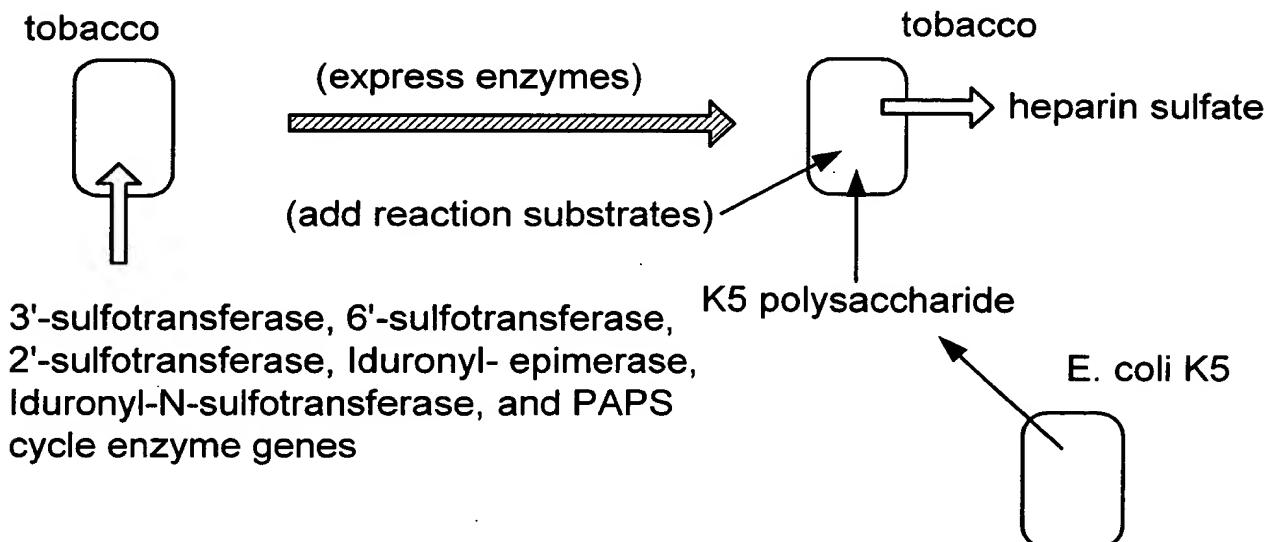
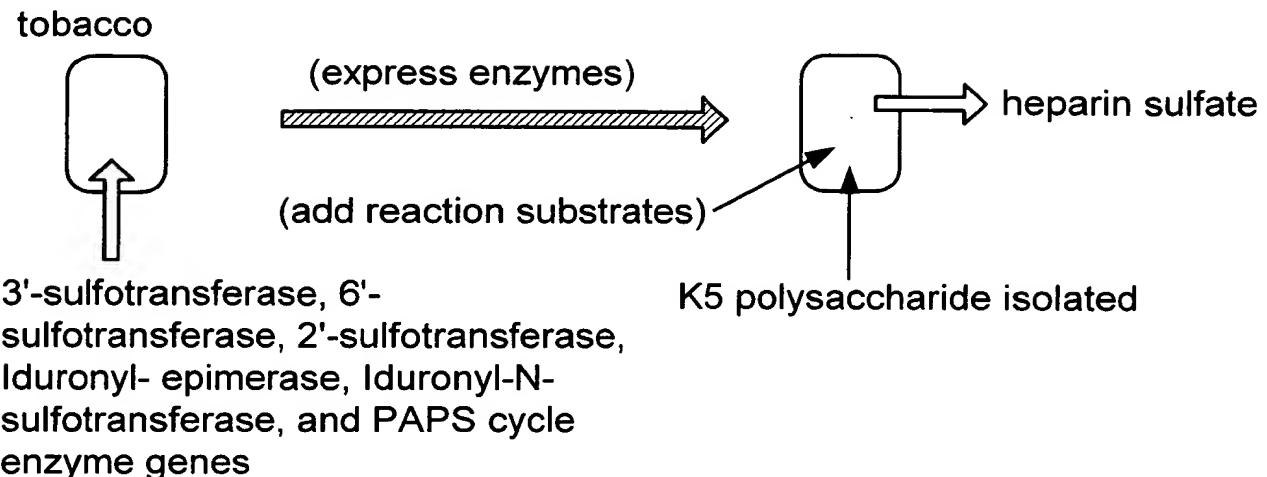


FIG. 6.





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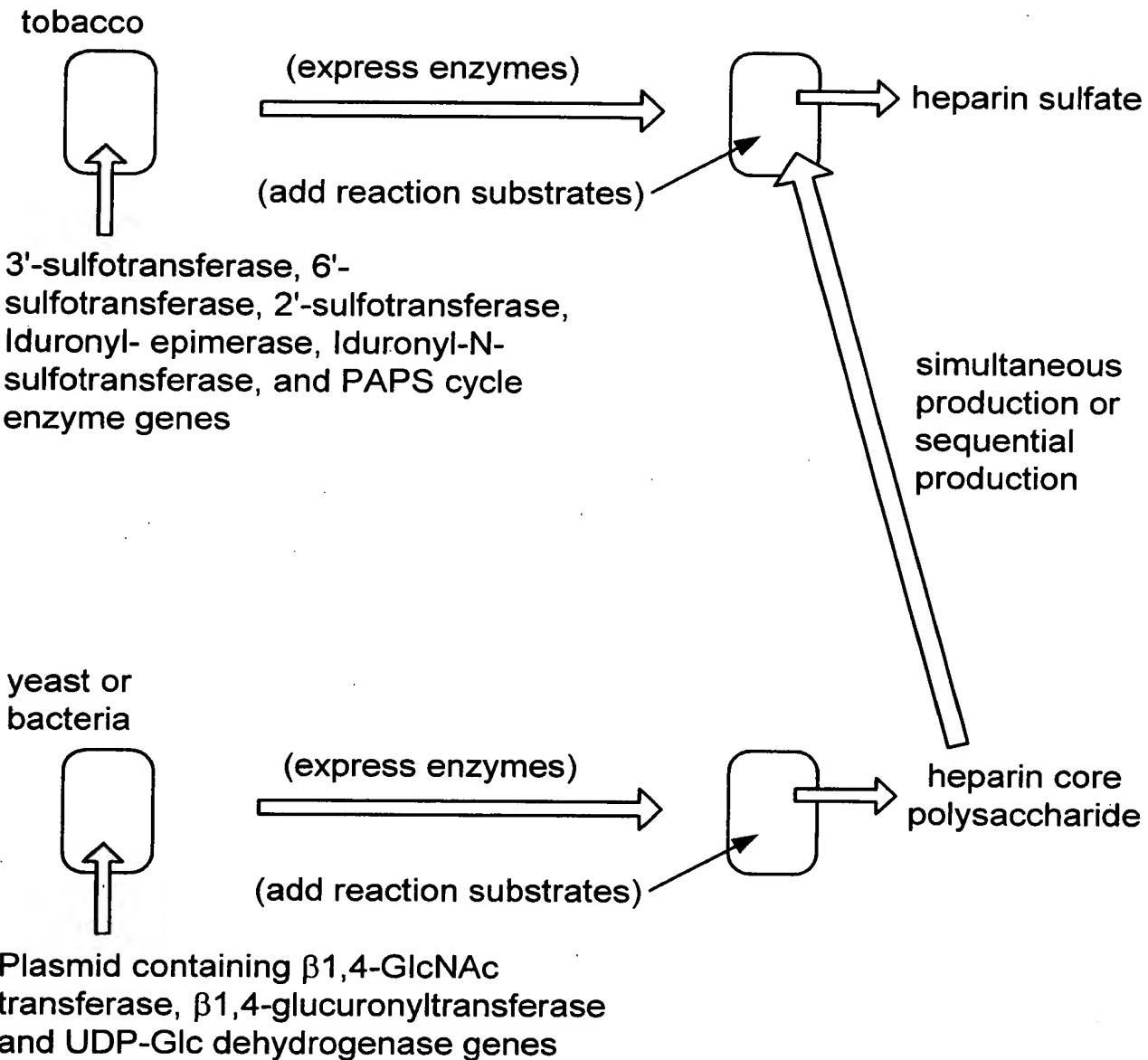
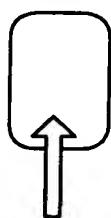


FIG. 7C.

yeast

A. niger



(express enzymes)

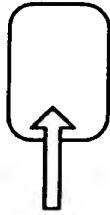
(add reaction substrates)

3'-sulfotransferase, 6'-sulfotransferase, 2'-sulfotransferase, Iduronyl- epimerase, Iduronyl-N-sulfotransferase, and PAPS cycle enzyme genes except ATP regeneration enzymes

heparin sulfate

simultaneous production or sequential production

yeast or bacteria



(express enzymes)

(add reaction substrates)



heparin core polysaccharide

Plasmid containing β 1,4-GlcNAc transferase, β 1,4-glucuronidyltransferase and UDP-Glc dehydrogenase genes

FIG. 7D.

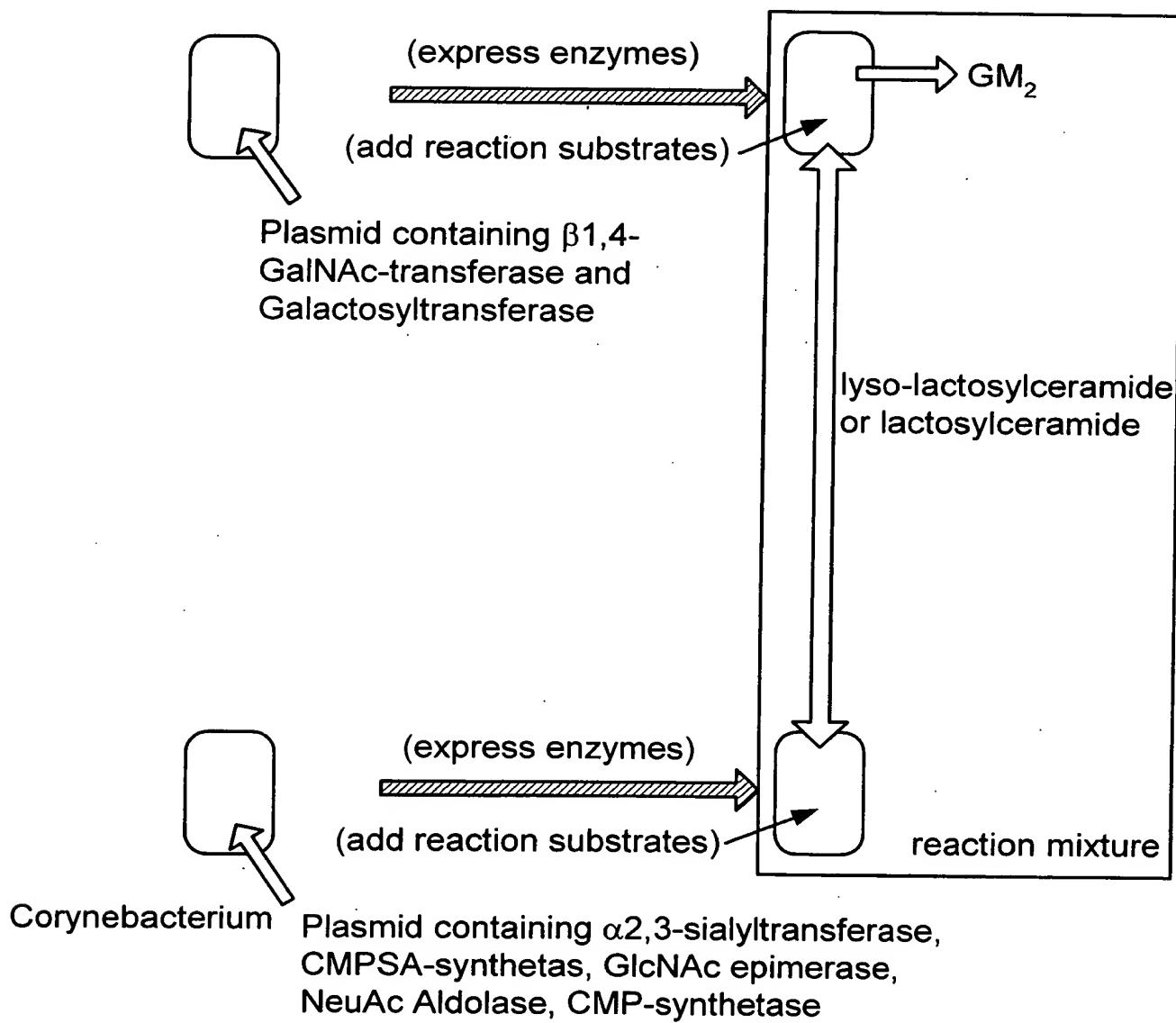


FIG. 8.

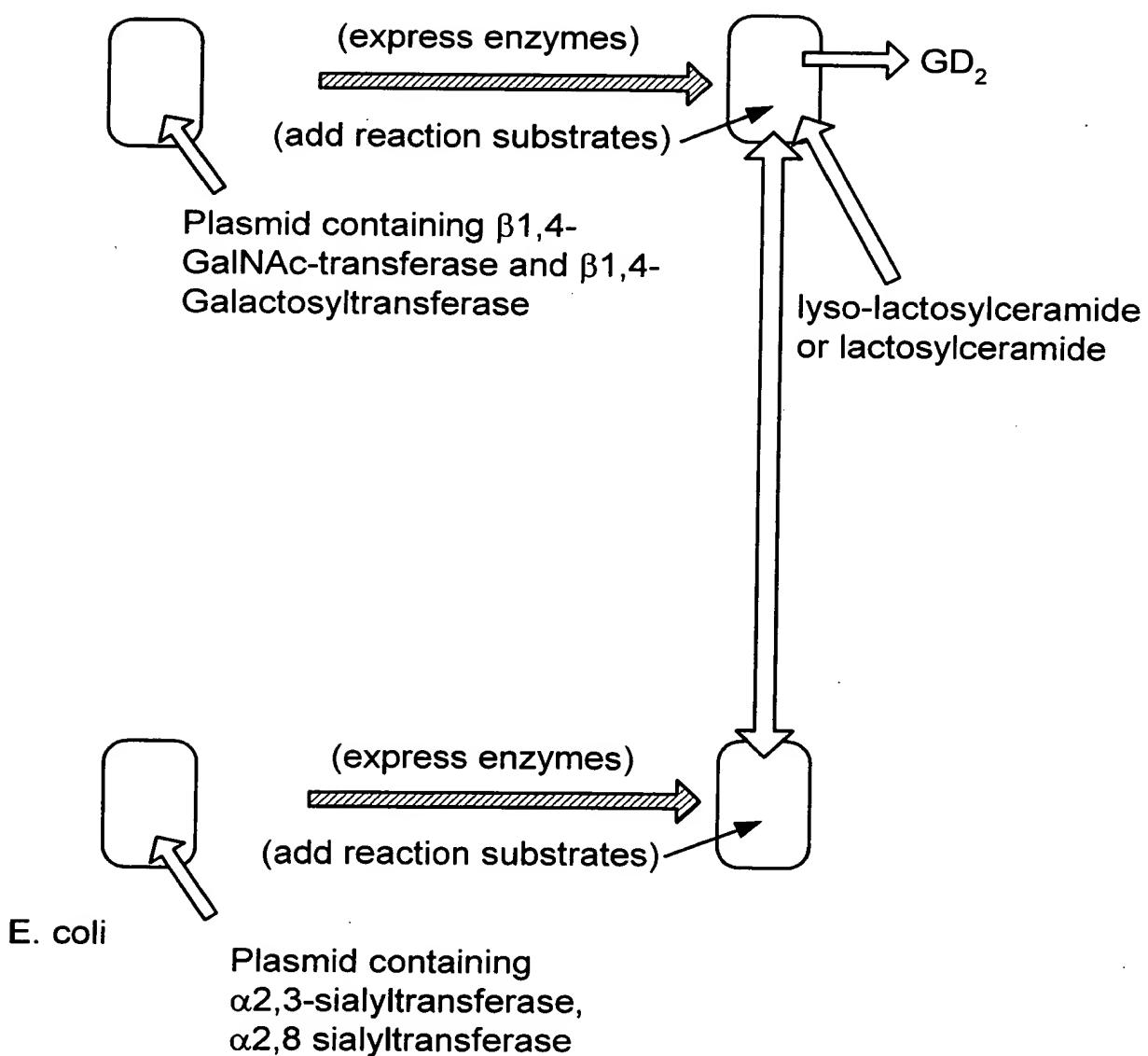


FIG. 9.



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E. coli

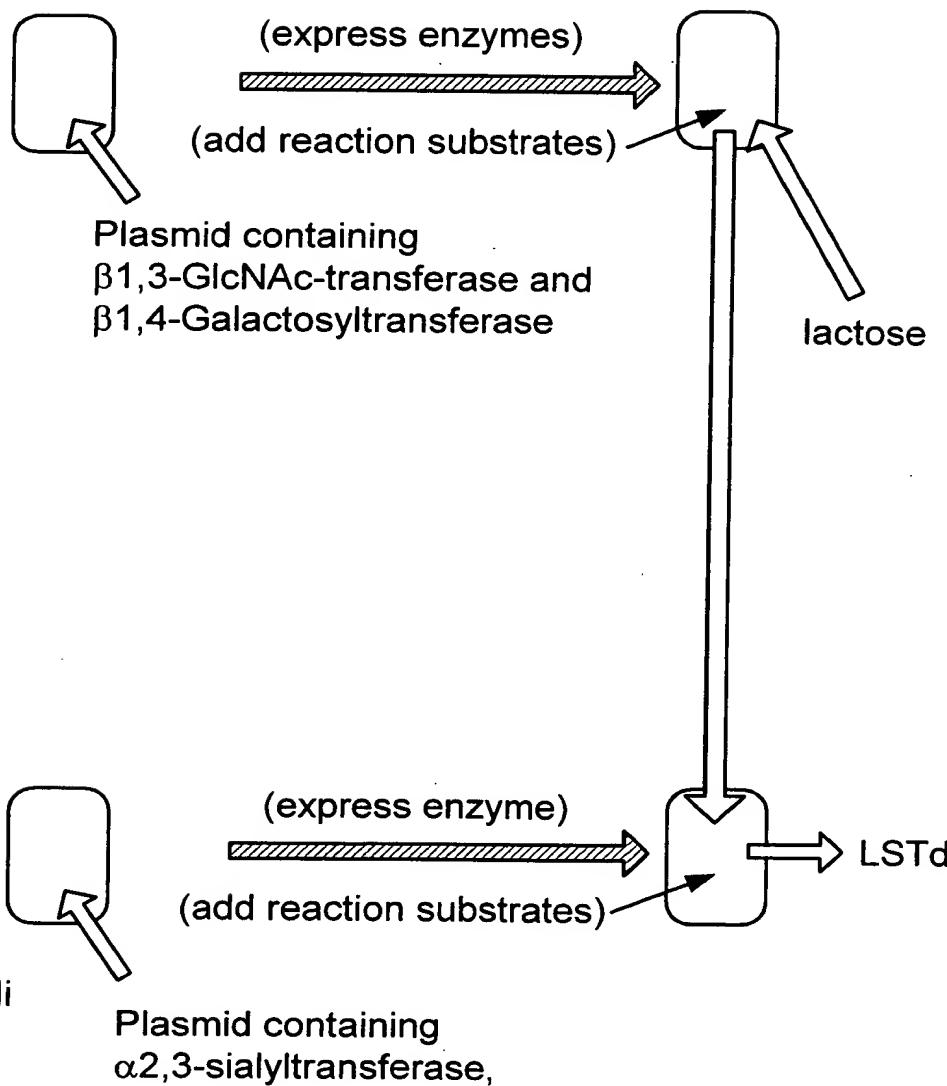


FIG. 10.

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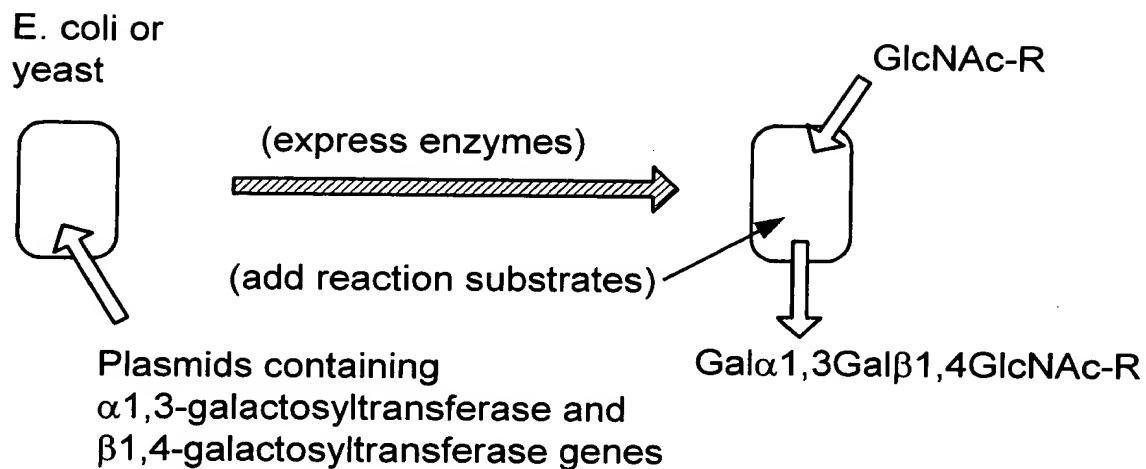


FIG. 11A.

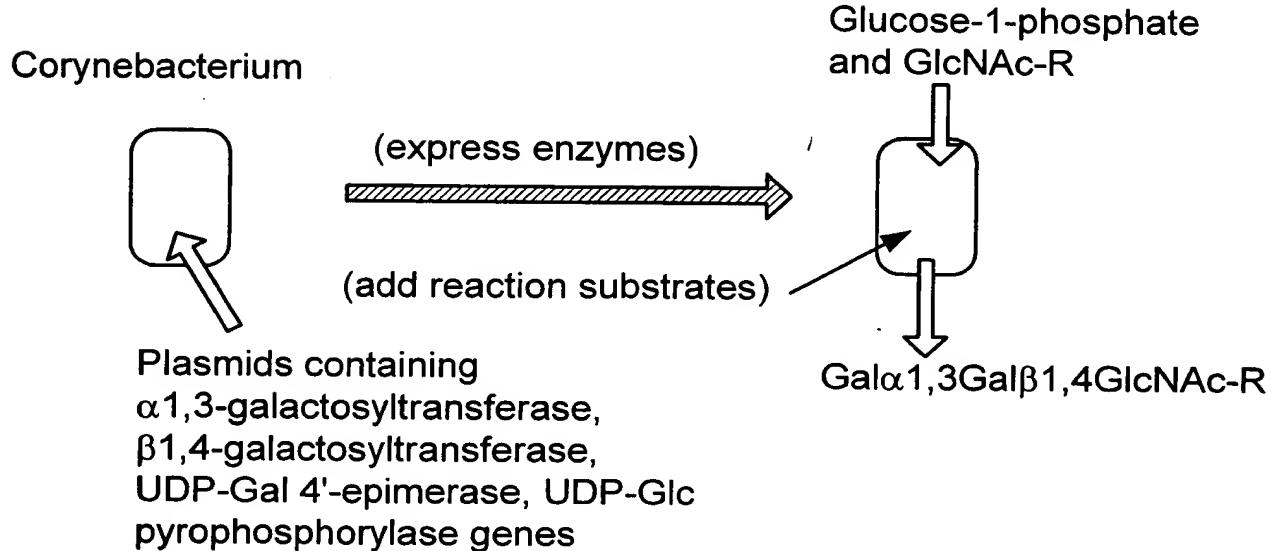


FIG. 11B.